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DOORSTOPPER TESTS IN WATERFILLED VERTICAL DRILL HOLES

G. Herget

Canadian Mine Technology Laboratory

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DOORSTOPPER TESTS IN WATERFILLED VERTICAL DRILL HOLES

by

G. Herget*

SUMMARY

Strain gauge adhesives are identified and procedures are provided to glue biaxial strain cells (doorstoppers) to the bottom of short vertical drill holes. These holes are often waterfilled and glueing is required under water. As a result the installing tool needs to be waterproofed and all contacts require the application of a water dispersant spray.

Acryl resins have been found to be most suitable for glueing under water, especially when 1% silane is added to improve bond strength. Prolonged exposure to water or high humidity will cause, however, bond deterioration and failure.

KEYWORDS: Stress determinations, under water glue, strain gauge bonding.

*Research Scientist, Canadian Mine Technology Laboratory, Mining Research Laboratories, CANMET, Energy, Mines and Resources Canada, Ottawa, Ontario.

RÉALISATION D'ESSAIS "DOORSTOPPER" DANS DES TROUS DE SONDES VERTICAUX REMPLIS D'EAU

par

G. Herget*

SOMMAIRE

Dans le présent rapport, on a identifié des adhésifs pour jauge de déformation ainsi que des méthodes de fixation pour les cellules biaxiales de déformation placées au fond de courts trous de sonde verticaux. Puisque ces trous sont souvent remplis d'eau, il est nécessaire de travailler sous l'eau pour fixer les cellules à l'aide de colle. Par conséquent, les outils utilisés pour travailler sous l'eau doivent être étanches et tous les contacts doivent être vaporisés avec un agent de dispersion d'eau.

Les résines acryliques se sont avérées les plus propices pour le collage sous l'eau, tout particulièrement lorsqu'on ajoute 1% de silane pour améliorer leur pouvoir agglutinant. Une exposition prolongée à l'eau ou un taux élevé d'humidité causera toutefois une détérioration de l'adhérence.

MOTS CLÉS: Détermination des contraintes, colle utilisée sous l'eau, jauge de déformation, adhérence.

*Chercheur scientifique, Laboratoire canadien de technologie minière, Laboratoires de recherches minières, CANMET, Énergie, Mines et Ressources Canada, Ottawa (Ontario).

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INTRODUCTION

Ground stress determinations are often carried out on the basis of strain recovery measurements where strain gauges are glued to the inside of boreholes. If the boreholes are wet or filled with water, glueing is often impossible or of poor quality if special procedures and adhesives are not used. With a need to carry out many strain recovery measurements in shallow vertical drill holes, suitable adhesives and procedures had to be developed for use.

GLUEING PROCEDURES FOR WET DRILL HOLES

The building industry uses epoxy and acrylic resins which are suitable for under water cementing. These glues are mechanically worked into the contact surfaces and the water displaced to obtain a fully glued contact. Epoxy resins harden very slowly at low temperatures and hardening cannot be accelerated significantly.

The velocity of hardening can, however, be easily controlled for acryl resins such as those commonly used for stress determinations, e.g. Philips PR 9244104 and Hoettinger X 60. Both contain Methylmethacrylate. Adding a coupling agent such as a silane to the resin will improve the rock-gauge bond significantly. Dr. R. Hiltscher of the Swedish State Power Board, Stockholm, Sweden recommended an addition of 1% by weight of silane to a glue which increased its strain gauge bond strength to gneiss and granite by 100% (Hiltscher 1979).

All plastic cements will absorb water to a degree which will affect glue quality. Because of this it is important to cover strain gauges with a generous amount of glue prior to water immersion and to keep the duration of glues exposure to water short.

In the case of the doorstopper the water layer between the rock surface and the glue can be removed by impacting and holding in place the installing tool carrying the doorstopper against the face. Rubbing the

glue in to the rock surface also helps. According to Hiltscher et al (1979) a high viscosity type glue is more advantageous in this case than a more fluid one. From a review of adhesives for strain gauges (Shields, 1970) it is evident, however, that prolonged exposure to water or high humidity will cause bond failure.

In 1981 a number of doorstoppers were glued under water at the Elliot Lake Laboratory using Fleming GC 104 cement which had 1% silane added to the resin. Acceptable bonding was achieved. This glue is available from Fleming Services, 15 Goppice Avenue, Great Shelford, Cambridge, CB2 5AQ, England.

In summary the following procedure is suggested to install a doorstopper biaxial strain cell:

1) drill hole to required depth;
2) flatten bottom of hole with coarse polishing bit;
3) smooth bottom of hole with fine polishing bit;
4) flush fine cuttings from hole;
5) blow water out until dry or until only clear water remains;
6) add one percent of silane (coupling agent) to resin and add hardener;
7) apply generous amount of high viscosity glue to strain gauge surface (> 2 mm);
8) use waterproof installing tool to place doorstopper quickly with impact on flat borehole surface;
9) rotate and twist doorstopper on surface to push water out and work glue into rock surface;
10) lock installing tool in place and wait for glue to set;
11) obtain first reading, overcore and retrieve core.

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